Plant Experiments

Grade Level: 4-8

Lesson Overview

Students will have an opportunity to explore the scientific method by designing mini experiments within a whole class experiment.

Student Objectives

1. Explain the requirements plants need to grow and thrive.
2. Apply the steps of the scientific method.

Materials

- ✓ seeds
- ✓ potting mix
- ✓ cups or pots
- ✓ paper towels
- ✓ potting mediums (sand, sawdust, pebbles or aquarium rock, vermiculite, perlite, rice, plant moisture crystals, etc.)
- ✓ variety of liquids (tea, coffee, sodas, sports drinks, lemonade, fruit juices, sugar water, salt water, fertilizer, etc.)
- ✓ oil or petroleum jelly
- ✓ thermometers
- ✓ plant fertilizer
- ✓ variety of liquid measuring devices (teaspoons, tablespoons, measuring cups of differing sizes)
- ✓ water
- ✓ rulers (optional if the teacher chooses to have students measure growth)
- ✓ various light sources such as a window, indirect light, dark closet, plastic grocery bags of varying colors, aluminum foil, or paper sack
- ✓ permanent marker
- ✓ plant journal worksheet

Procedure

Objective 1: Explain the requirements plants need to grow and thrive.

Review with students' what plants need to grow and thrive. Plants need light, air, water, soil or something to grow in, nutrients, space, proper temperature and time to grow.

Objective 2: Apply the steps of the scientific method.

1. **Introduce or review the scientific method**.

   Purpose/Question: By observing the world around us, we may question how things work. Why are you doing this experiment?

   Hypothesis: A hypothesis provides a possible answer to a question. It must explain observations, be testable, and predict new findings. What do you think will happen during this experiment?

   Experiment: A scientific test of the hypothesis is an experiment. It must be repeatable. It must only test one variable at a time. A variable is one of the things that can be changed or controlled. As experiments are conducted, observations are made, and data is collected. Then the data is interpreted or analyzed. What materials will you need? What steps will you follow? What changes occurred during the experiment?

   Conclusion: From the experiment, the results should be stated in reference to the hypothesis. Did it support or not support the hypothesis? What did you learn from this experiment?

2. **Using the scientific method**, set up several plant experiments to explore these needs. Keep in mind only one factor can be varied at a time. Students could be divided into groups. Then, each group would conduct an experiment for one plant need and report their findings to the class.

   As a part of the scientific method, students may come up with ideas to test. Please keep in mind that only one type of plant should be used. A good experiment only has one variable. Students should consider each idea in terms of control versus treatment, how the treatment will be done, and what will be measured as well as when and how. In case some additional assistance is needed, here are some ideas to try.

   One method for mini experiments within a whole class experiment is to divide the class into groups (3 students per group is preferable, but more students in each group is workable). Each group will be assigned a different “mini experiment” (i.e.: type of potting medium, type of liquid, amount of liquid, amount of light, etc.). Either the teacher can provide a variety of materials for each group to choose from for their experiment, or students can be asked to bring in the variables for their group. Each group will have 3 cups per mini experiment to choose variables for.

   Before each group chooses their variables, the entire class needs to come to a consensus on how much and how often to water the seed cups (a

Monday/Wednesday/Friday rotation seems to work well). Individual groups can then decide what variables to apply to their mini experiment.

Tips & Tricks:

- Using individual water bottles to mix sugar water, salt water, fertilizer water, etc. works well for different types of liquids.
- Mark each cup or container with a group number and cup letter (3A, 3B, 3C) so that students can easily refer to their plant journal for each cup's variable.
- Types of liquid bottles (soda, mixed water bottles, juice, etc.) can be labeled with the group/cup code.
- Having a measuring spoon or device for each individual cup speeds up watering time.
- It may be easiest for students to form their hypothesis and draw their conclusion only from their group's mini experiment, but it is encouraged to have groups share with the entire class how other variables reacted during the experiment so that students can compare and learn from the whole class experiment.
- Space variable will take a considerably longer amount of time, as the plants will need to grow so they are competing for light, space, and nutrients.
- Temperature variable may not be as easy to complete with the ice packs and heating pad.
- Air variable requires plants with leaves. This experiment could be completed using plants from other experiments once seeds germinate and grow leaves.

Light: Put one plant in the sun, one in indirect light, and one in the dark. Then observe the plant growth over a period of time. Observations may include leaf color, leaf size, plant height, distance between leaves, etc. Another option: cover some leaves on a plant with aluminum foil. Set the plant in a window. After different amounts of time, remove the foil from one leaf at a time. To carry this even further, observe the leaves' response after being uncovered. One suggestion for the control would be to place the plants in the appropriate lights according to requirements for the particular plants.

Water: Using specific amounts of water, water one plant regularly, water another very little, over water another and don't water one. One suggestion for the control would be to give the plant the appropriate amount of water according to the

requirements of the particular plant. Another option would be to utilize different amounts of water from a variety of measuring devices.

Potting medium: Plant some seeds or small plants in soil, sawdust, plant moisture crystals, wet paper towels, sand, etc. Students may come up with some creative ideas. The seeds or plants placed in the soil may serve as the control for the experiment.

Nutrients/types of liquid: Try different items to feed the plants. For example, give one plant nothing, give another some plant fertilizer, mixed according to directions on container, give another salt water, give another tea or coffee, give another soda, etc. To make the salt water, mix ½ - 1 teaspoon of salt in 1 cup of water. (Real life application for the salt solution is the salt used on the roads and walkways in the wintertime.) The plant which receives nothing may serve as the control for the experiment.

Space: In equal size pots of soil, plant different amounts of seeds. For instance, plant 1 seed in a pot, 2 seeds in another, 6 in another, and 10 in another. Observe the growth and vigor of the plants over time. One suggestion for the control would be to plant the seeds according to the space requirements on the seed packets. Any increase or decrease in spacing would then serve as the variables.

Temperature: Place one plant in a very warm area, one is a cold area, one in a hot area. Try to maintain the same lighting for each area. Use thermometers to record the temperatures. An ice pack and a heating pad set on low may be ideas of ways to alter the temperature.

Air: Cover some plant leaves with oil or petroleum jelly so these leaves cannot breathe. Observe any similarities or differences in the covered leaves compared to those not covered. Another thought would be to completely cover all the leaves of the plant.

Extension Activities

1. Visit a local farm, greenhouse, or nursery. If unable to visit, invite someone in that profession to visit the class.
2. Experiment with plant tropisms, the tendency to turn or grow toward or away from something. Gravitropism is the plant’s response to gravity. Phototropism is a plant’s response to light.
3. Complete the Percent Germination of a Soybean Sample.
4. Graph the growth of each variable of a groups mini experiment.
5. Sprouting Success in Illinois from North to South lesson coordinates with this lesson.

6. Using the seed packets from the plant experiment, have students find a variety of information (days to harvest, planting depth, spacing, Hardiness Zone, etc.).

Additional Resources

- Illinois Agriculture in the Classroom Interactive Horticulture and Soil Ag Mags: http://www.agintheclassroom.org/TeacherResources/AgMags.shtml

Standards

Illinois Science Standard

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Illinois English Language Arts Standard

RST1 Cite specific textual evidence to support analysis of science and technical texts.

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Name_____

Plant Experiment

Group Members:

Hypothesis:

Experiment (include type and amount of potting medium, type and amount of liquid, watering frequency, placement for lighting):

Cup A variable–

Cup B variable –

Cup C variable–

Conclusion:

Name_____

Plant Experiment Journal

Date	Observation	Procedure